

CLAIMS

1. Dispensing apparatus for a liquid product contained in a receptacle (4) comprising a feed nozzle (4a), said apparatus including an assembly housing (2) or a frame (3) for receiving a mechanism actuated by exerting a pressure (F) on an actuator (30) to draw from the receptacle (4) through the orifice (11a) of a dosing chamber (11) a determined quantity of said liquid by means of a plunger (10) compressing a return spring (14), and to then eject said liquid to the exterior, characterised in that the mechanism includes an element that is mobile in rotation (50) or translation (51) via the action of the actuator (30), said mobile element (50, 51) remaining in a first position at the start or rest of the actuator's (30) travel, then acting on a control member for the plunger (10) to fill the dosing chamber (11) with liquid and to compress the return spring (14) of said plunger (10), at the end of travel said mobile element (50, 51) then passing into a second position placing said dosing chamber (11) in communication with the exterior by the same orifice (11a) as that allowing the liquid to be drawn and, releasing the return spring (14) of the plunger (10), to drive the liquid from the chamber (11) through a through passage (7) of the housing (2) or the frame (3).

2. Apparatus according to claim 1, characterised in that the actuator (30) is returned to the rest position by resilient return means wound by the travel of said actuator (30).

3. Apparatus according to claim 2, including means for re-injecting the liquid contained in the dosing chamber (11) into the receptacle (4) before the actuator (30) has reached the rest position if the pressure (F) is released before the mobile element (50, 51) has reached the second position for ejection.

4. Apparatus according to claim 1, characterised in that the actuator (30) further includes a panel (39) blocking the through passage (7) of the housing (2) or frame (3) in the rest position, said panel (39) including an opening (37) that faces said passage (7) in the ejection position.

5. Apparatus according to claim 1, characterised in that the mobile element is formed by a drum (50) provided, on its flanks (52a, 52b) with studs (54a, 54b) rotatably mounted in the housing (2) or frame (3) in its diametral part an assembly formed by the dosing chamber (11), the plunger (10) and the return spring (14), said drum (50) being able to occupy a first filling position in which the orifice (11a) of the dosing chamber (11) is facing the feed nozzle (4a) of the receptacle (4), and after a rotation through an angle ( $\alpha$ ), to occupy a second ejection position in which said orifice (11a) of the dosing chamber (11) is facing the through passage (7) of the housing (2).

6. Apparatus according to claim 5, characterised in that each rotation stud (54a, 54b) of the drum (50) includes a loose pinion (60) whose shake is limited by two pins (61a, 61b) secured to said pinion (60) and engaged in elongated bean-shaped holes (66a, 66b) of the drum (50), and in that the actuator (30) is U shaped surrounding the drum (50), each arm (34a, 34b) including both a stop member (36) and a straight rack (38) meshing with the pinion (60), said stop member (36) actuating, in a first movement phase of the actuator (30), a lever (24) articulated in its median part in the housing (2) and the end of the which moves a control member (20) for the plunger (10) for filling the dosing chamber (11), and said straight rack (38) driving, in a second movement phase of the actuator (30), the pinion (60) and the drum (50) to make it rotate through the angle ( $\alpha$ ).

7. Apparatus according to claim 6, further including a safety catch (62) pivoted in the housing (2) and engaged in a notch (64) of the drum (50) to immobilise said drum while the dosing chamber (11) is being filled, said catch (62) then being released from the notch (64) by a snag (28) of the lever (24) to allow the drum (50) to rotate until said drum reaches the liquid ejection position.

8. Apparatus according to claim 6, characterised in that the plunger control member is formed by a staple (20) secured to the end of the plunger (10), compressing the return spring (14) and including laterally two branches (22a, 22b) the ends of which follow, once filling is complete, the external contour of a circular cam (6), formed in the housing (2) or frame (3), during rotation of the drum (50) from the filling position to the ejection position in which the staple (20) is released from the cam (6) allowing the return spring (14) to push the plunger (10).

9. Apparatus according to claims 1 to 8, characterised in that the resilient return means of the actuator are formed by two pivoting racks (40a, 40b) connected by a bridge (42) compressed by a spring (46), the teeth of said pivoting racks (40a, 40b) meshing with the pinions (60) of the drum (50).

10. Apparatus according to claim 1, characterised in that the dosing chamber (11) is formed in a unit (9) secured to the housing (2) or frame (3), and in that the mobile element is formed by a valve (51) that can be moved by the actuator (30) against the return force of springs (53a, 53b) from a first filling position by means of a passage (59) formed in the thickness of said valve (51) and connecting the orifice (11a) of the dosing chamber (11) and the nozzle (4a) of the receptacle (4), to a second ejection position in which the orifice (11a) of the dosing chamber (11) is placed in communication with the exterior through a hole (57) in the valve facing the through passage (7) of the housing (2) or frame (3).

11. Apparatus according to claim 10, characterised in that the actuator (30) includes, parallel to its direction of movement, a plate (31) provided with an opening (31a) and against which a reverse L-shaped part is mounted so as to tip, the large arm (45) of said part being provided with an opening (45b) facing the opening (31a) of the plate (31) and including on each side of its base, a first inclined plane (35a) actuating, in a first movement phase of the actuator (30), the plunger control member for filling the dosing chamber (11), and the end of the small arm (43) of said part acting, in a second movement phase of the actuator, on the valve (51) to bring said valve into a position where the orifice (11 a) of the dosing chamber (11), the openings (57, 31a) of the valve (51) and the plate (31) and the through passage (7) of the housing (2) are aligned to allow the liquid to be ejected.

12. Apparatus according to claim 11, characterised in that, during the first and second movement phases of the actuator (30), the large arm (45) of the reverse L-shaped part (41) is held pressed against the plate (31) by means of a spring (47) arranged between the head (32) of the actuator (30) and the small arm (45) of said part.

13. Apparatus according to claim 11, characterised in that the plunger control member is formed by a clamp (21) the base of which allows the plunger (10) to be fixed, the return spring (14) to be held, and two branches (23a, 23b), ending in two lugs (29a, 29b) each provided with two chamfers (25a, 25b) substantially parallel to the inclined plane (35a) of the L-shaped tipping part (41), to be connected.

14. Apparatus according to claim 11, characterised in that the reverse L-shaped tipping part further includes on each of its edges a second inclined plane (35b) parallel to the first inclined plane (35a) allowing said part to move aside by tipping against the chamfers (25a, 25b) of the clamp (21) when the actuator (30) is returned to the rest position by the resilient return means.

15. Apparatus according to claim 14, characterised in that the resilient return means are formed by two bending springs (49a, 49b) one end of which is secured to the unit (9) of the housing (2) or frame (3) and the other end of which abuts underneath the head of the actuator (30).

16. Apparatus according to claim 14, characterised in that the resilient return means are formed by a helical spring (39) disposed between the head of the actuator (30) and the unit (9) of the housing (2) or frame (3).

17. Apparatus according to claim 10, characterised in that the unit (9) includes vertically a wall (15) against which a reverse L-shaped part can slide or tip, the large arm (45) of said part being provided with an opening (45b) and the small arm (43) being flexible and gripped at its end in an extension (48) of the actuator, said L-

shaped part includes on each side of its base, a first inclined plane (35a) actuating, in a first movement phase of the actuator (30), the plunger control member for filling the dosing chamber (11), and the end of the small arm (43) of said part acting, in a second movement phase of the actuator, on the valve (51) to bring said valve into a position where the orifice (11a) of the dosing chamber (11), the openings (57, 31a) of the valve (51) and the plate (31) and the through passage (7) of the housing (2) are aligned to allow the liquid to be ejected.

18. Apparatus according to claim 1, characterised in that the receptacle (4) is formed by a bottle fixed in the housing (2) or the frame (3).

19. Apparatus according to claim 1, characterised in that the housing (2) or the frame (3) further includes a sliding element (8) allowing the distance between the point of ejection of the liquid and the point of impact on a target to be adjusted.

20. Apparatus according to claim 19, characterised in that the liquid is an ophthalmic product and in that the target is a patient's eye.

21. Apparatus according to claim 1, characterised in that the plunger (10) has a head formed by a reversed double cone (1) made of a rigid material (16a) one end of which is fixed onto the rod (13) of the plunger (10), and the other end of which forming the plunger head (16b) is fitted with a flexible material with a rounded end.

22. Apparatus according to claim 21, characterised in that the bottom of the dosing chamber (11) has a complementary shape to the end of the plunger head.

23. Apparatus according to any of claims 1 to 22, characterised in that the same actuator is used for the actions from the rest position to ejection.

24. Apparatus according to any of claims 1 to 22, characterized in that the actuator performs a substantially continuous movement.

25. A dispensing apparatus for a liquid product, the apparatus comprising a) a housing (2) or frame (3), b) a receptacle (4) for the liquid with a feed nozzle (4a) arranged substantially stationary with respect to the housing or frame, c) a dosing chamber (11) having an orifice (11a), d) a mechanism arranged to allow at least ejection of liquid through the orifice and e) a through passage (7) arranged to allow the ejected liquid to pass in a direction different from the feed nozzle or opening, characterized in, i) that the mechanism comprises a mobile element arranged movable with respect to the housing or frame between at least a first position in which the orifice of the dosing chamber and the feed nozzle or opening are in flow communication and a second position in which the orifice and the through passage are in flow communication, and ii) that the mechanism is arranged to allow aspiration of liquid through the orifice when the mobile element is in the first position and ejection of liquid through the orifice when the mobile element is in the second position.

26. The apparatus of claim 25, characterized in that the mobile element is arranged to move or carry the dosing chamber between a filling position, when the mobile element is in the first position, and an ejection position, when the mobile element is in the second position.

5 27. The apparatus of claim 26, characterized in that the dosing chamber comprises a substantially cylindrical barrel, defining a concentric barrel axis.

28. The apparatus of claim 27, characterized in that the mobile element is arranged to move or carry the dosing chamber in a rotational movement around a rotation axis different from the barrel axis.

10 29. The apparatus of claim 28, characterized in that the rotation axis is substantially perpendicular to the barrel axis.

30. The apparatus of claim 25, characterized in that the mobile element comprises a valve (51), having a passage (59) and a hole (57) or the through passage (7), the passage being arranged to connect the nozzle or opening with the orifice when the mobile element is in the first position and to align the orifice with the hole or the through passage when the mobile element is in the second position.

31. The apparatus of claim 30, characterized in that the passage is arranged to be shut off when the mobile element is in the second position.

20 32. The apparatus of claim 31, characterized in that the passage is shut off in both ends.

33. The apparatus of claim 30, characterized in that the dosing chamber is arranged substantially fixed with respect to the housing or frame.

34. The apparatus of claim 25, characterized in that the mechanism is arranged to perform in sequence the aspiration of liquid in the first position, the movement of the mobile element to the second position, the ejection of liquid in the second position.

35. The apparatus of claim 34, characterized in that the mechanism is arranged to perform the aspiration by retraction of a pump member against a return spring and to perform the ejection by release of the return spring.

30 36. The apparatus of claim 34, characterized in that the mechanism is arranged to allow return the mechanism to the start or rest position after liquid ejection.

37. The apparatus of claim 36, characterized in that the mechanism is arranged to allow return of the mechanism to the start or rest position also before liquid ejection.

38. The apparatus of claim 37, characterized in that the mechanism is arranged to reinject the aspirated liquid in the receptacle (4) if the return takes place before ejection.

39. The apparatus of claim 36, characterized in that a return member (40) is arranged to bias the mechanism towards the start or rest position.

40. The apparatus of claim 25 or 34 to 39, characterized in that at least one actuator is arranged to operate the mechanism.

41. The apparatus of claim 40, characterized in that the actuator is arranged to be manoeuvred by application of manual force (F).

42. The apparatus of claim 40, characterized in that the actuator is arranged perform a substantially continuous movement during which the mechanism performs at least the aspiration step and the movement of the mobile element between the first position and the second position.

43. The apparatus of claim 42, characterized in that the actuator is arranged to include in the substantially continuous movement also the ejection step for the mechanism.

44. The apparatus of claim 43, characterized in that the actuator is arranged to give a tactile feed-back immediately before the ejection step in the continuous movement.

45. The apparatus of claim 25, characterized in that the dosing chamber comprises a substantially cylindrical barrel, defining a concentric barrel axis and having a substantially constant cross-section area perpendicular to the barrel axis, and a plunger inserted in the barrel and being movable along the barrel axis.

46. The apparatus of claim 45, characterized in that the orifice has a substantially smaller cross-section area than the barrel.

47. The apparatus of claim 46, characterized in that the length of the orifice in the liquid flow direction is substantially shorter than the plunger movement during aspiration and/or ejection.

48. The apparatus of claim 47, characterized in that the orifice length to plunger movement length is less than 1:5, preferably less than 1:10 and most preferably less than 1:20.

49. The apparatus of claim 25, characterized in that the orifice is arranged to create a liquid spray.

50. The apparatus of claim 25, characterized in that the orifice is arranged to create a substantially coherent stream.

51. The apparatus of claim 25, characterized in that in the second position the orifice is arranged to eject liquid substantially directly into the air.

52. The apparatus of claim 51, characterized in that the through passage is substantially wider than the width of the orifice.

53. The apparatus of claim 52, characterized in that any apparatus part in front of the orifice is substantially wider than the orifice.

5 54. The apparatus of claim 25, characterized in that it comprises an eye piece or eye cup designed to define a predetermined distance to the orifice.

55. A method for operating a dispensing apparatus for a liquid product, the apparatus comprising a) a housing (2) or frame (3), b) a receptacle (4) for the liquid with a feed nozzle (4a) arranged substantially stationary with respect to the housing or  
10 frame, c) a dosing chamber (11) having an orifice (11a), d) a mechanism arranged to allow at least ejection of liquid through the orifice and e) a through passage (7) arranged to allow the ejected liquid to pass in a direction different from the feed nozzle or opening, characterized in the steps of i) connecting the orifice and the nozzle or opening in flow communication, ii) filling liquid into the dosing chamber through  
15 the orifice, iii) aligning the orifice with the through passage, and iv) ejecting liquid from the dosing chamber through the orifice.

56. The method of claim 55, characterized in any apparatus or step characteristic of claims 1 to 54.